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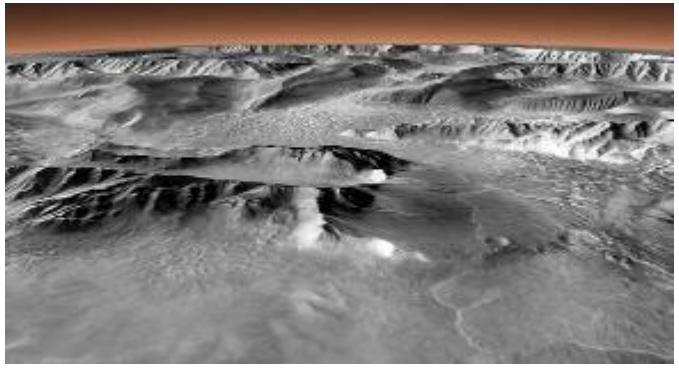
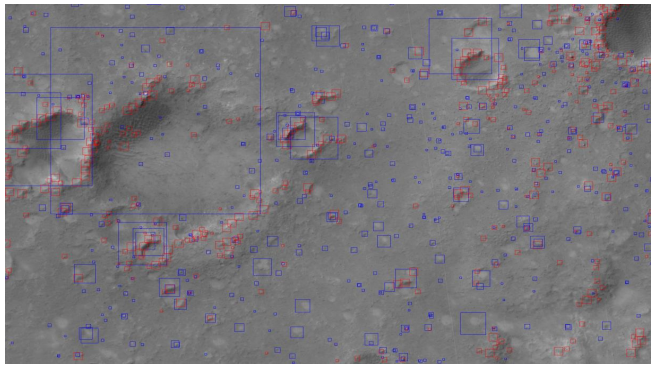
California Institute of Technology
Pasadena, California

Planetary Surface Visualization & Analytics

Planetary Science Informatics and Data Analytics

Emily Law





These activities were carried out at the Jet Propulsion Laboratory, California Institute of Technology, under a contract with the National Aeronautics and Space Administration.

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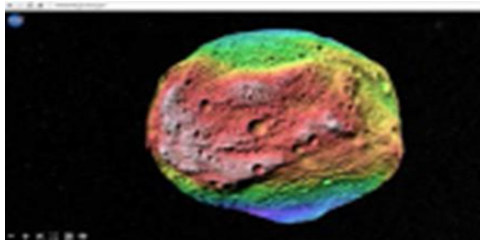
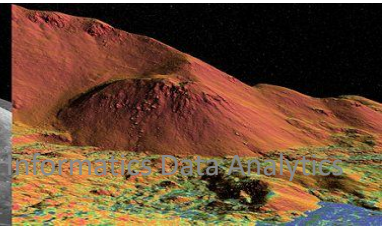
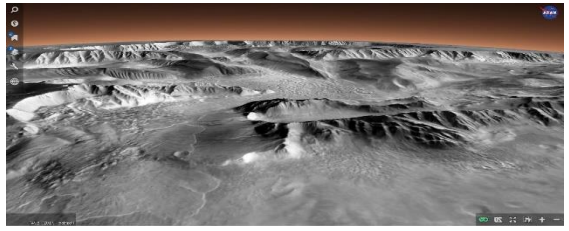
Solar System Treks Project

- Development and operations at JPL
- An element of NASA's Solar System Exploration Research Virtual Institute (SSERVI)
- A family of web based interactive portals for mission planning, scientific research and public outreach
  - Planetary surface visualization and Analysis tools
  - GeoSpatial Data products based on PDS data collected by many past and current missions
- Standard GeoSpatial Data Access APIs
  - A variety of user interfaces (e.g., virtual reality goggles)
  - A variety of external platforms (e.g., Eyes on Solar System, planetariums)
- Publicly available portals
  - Mars (https://marstrek.jpl.nasa.gov)
  - Moon (https://moontrek.jpl.nasa.gov)
  - Vesta (https://vestatrek.jpl.nasa.gov)
  - More to come (e.g., Phobos, Ceres, Titan, IcyMoons)



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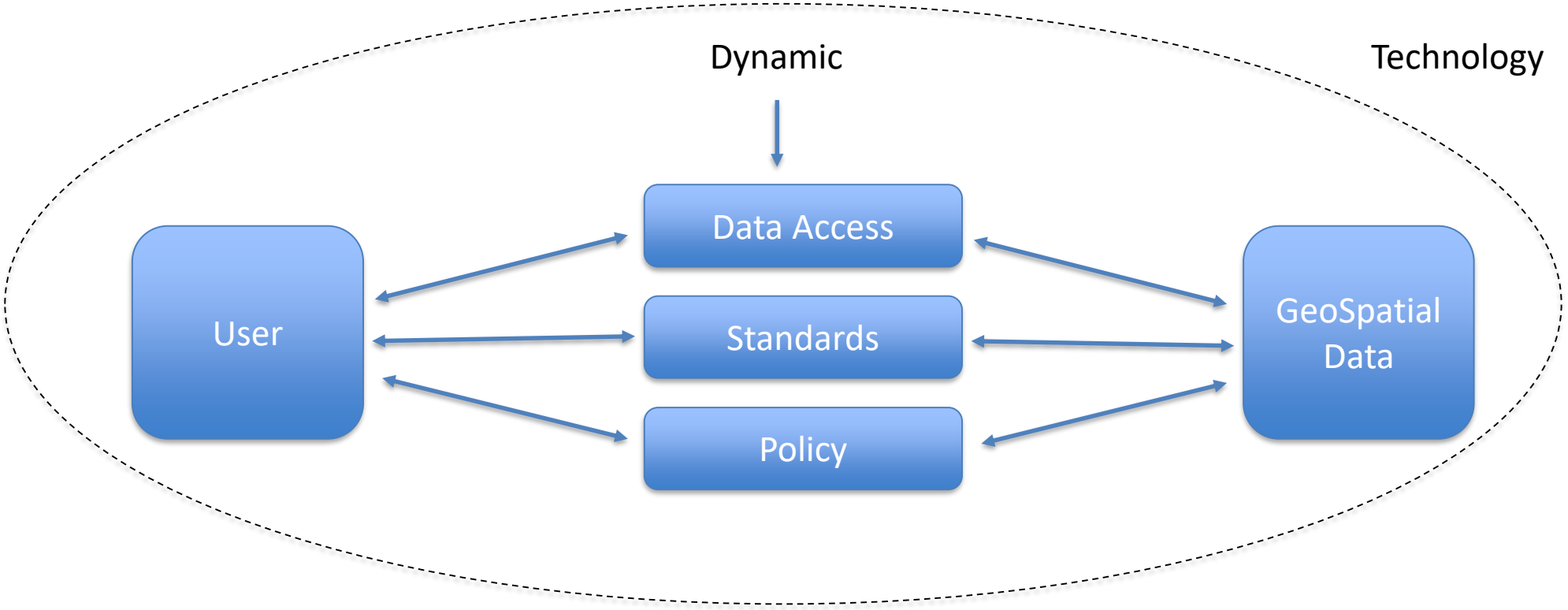
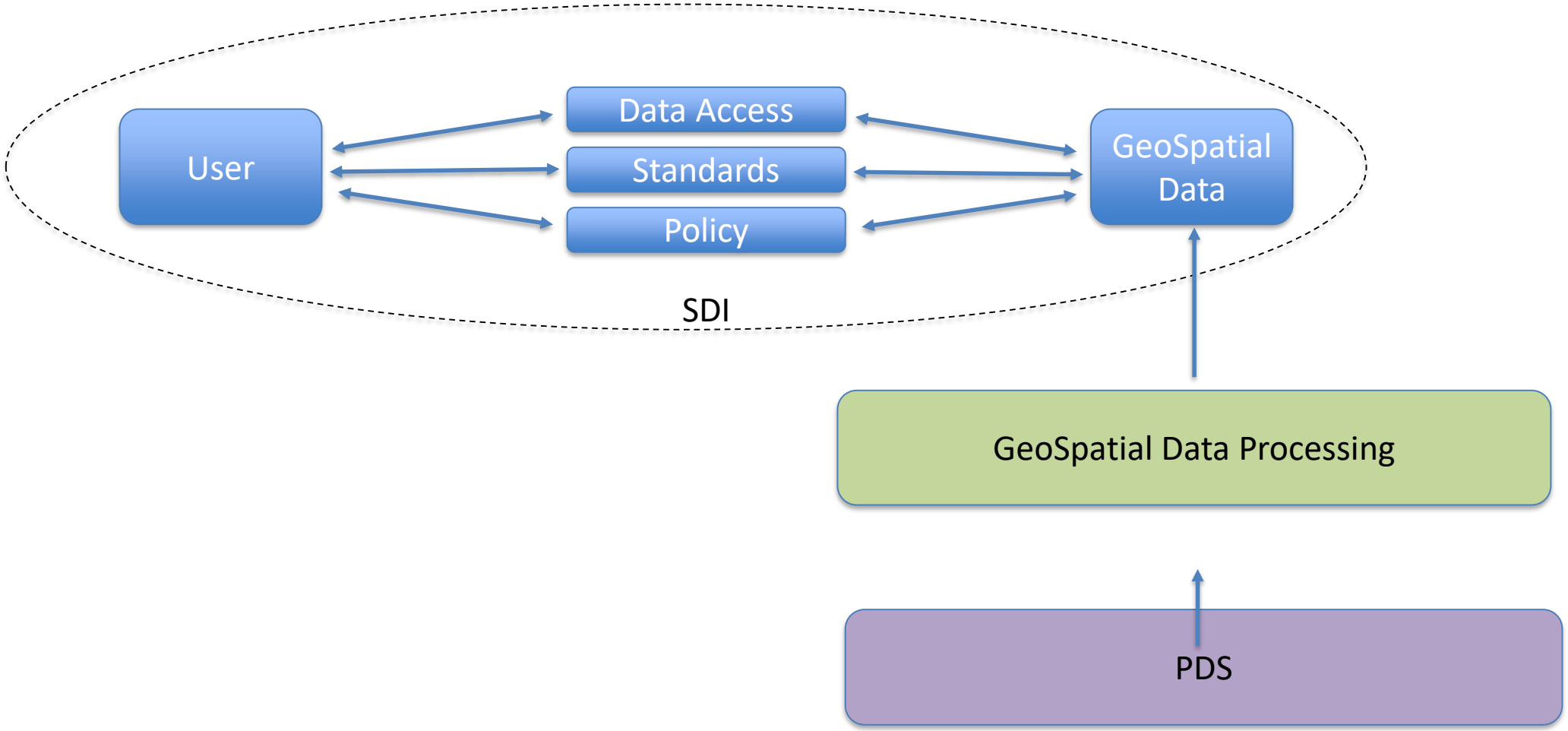
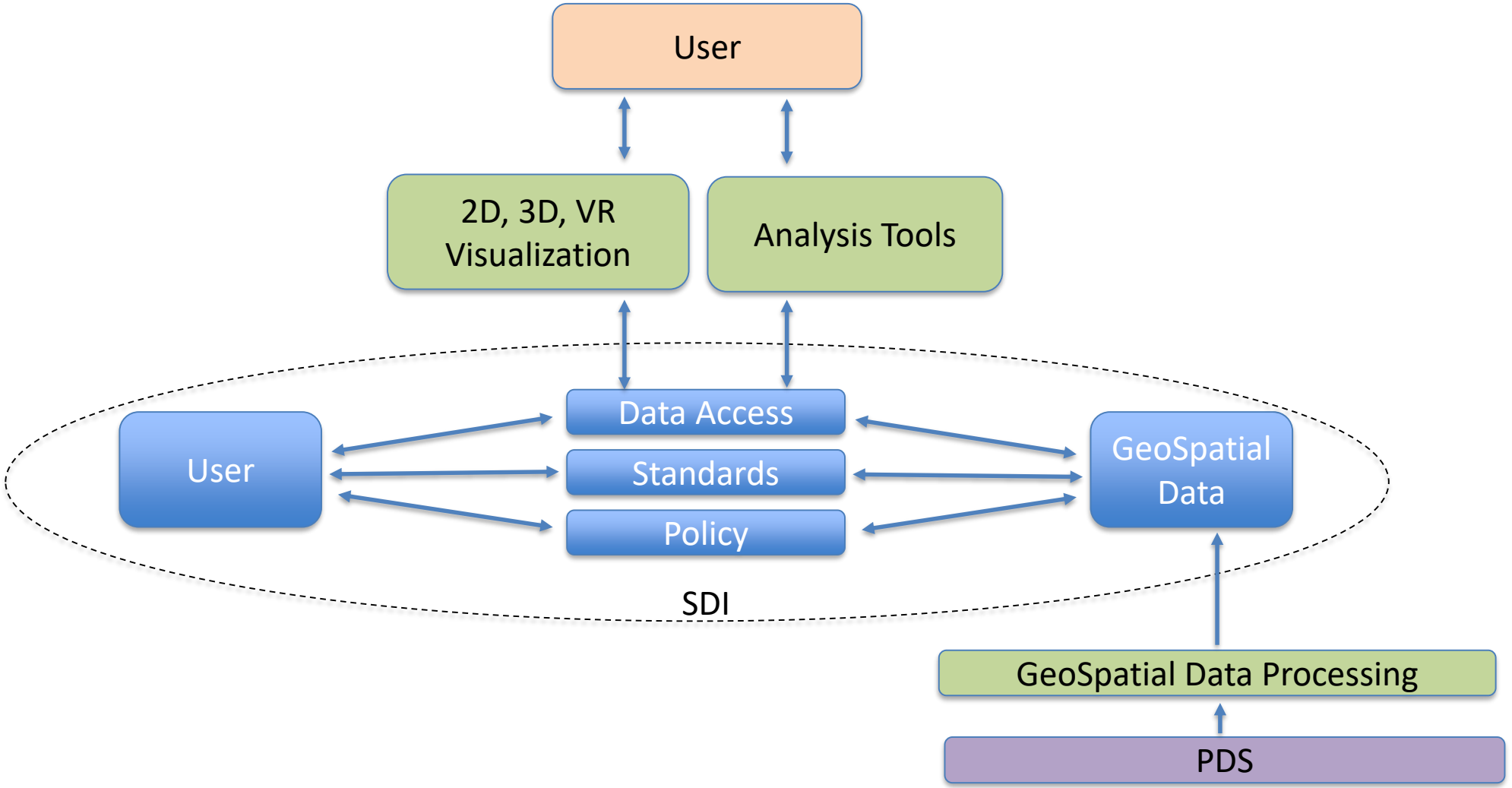
Spatial Data infrastructure (SDI)



PDS / SDI


User
Data Access
Standards
Policy
GeoSpatial Data
SDI
GeoSpatial Data Processing
PDS

SSTP / PDS / SDI


User
2D, 3D, VR Visualization
Analysis Tools
Data Access
Standards
Policy
User
GeoSpatial Data
SDI
GeoSpatial Data Processing
PDS

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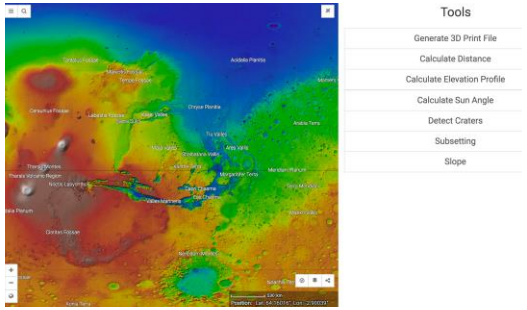
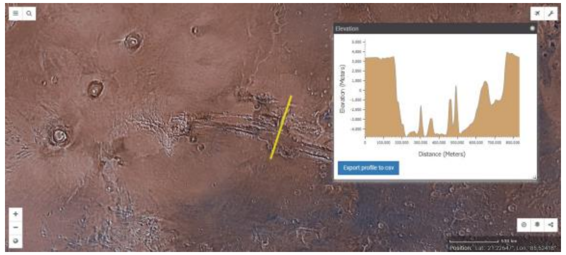
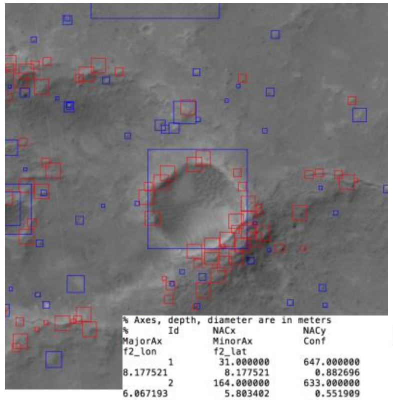
Analysis Tools

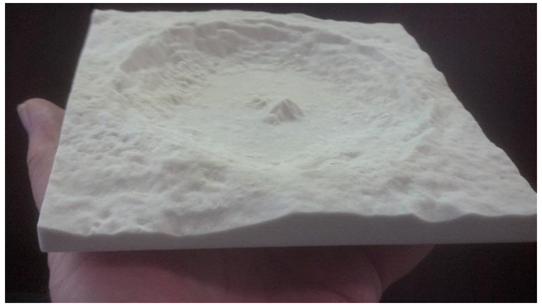
- Basic tools
  - Distance, Elevation, Sun Angle, 3D prints generation

- Advanced tools for exploration and research
  - Lighting, Crater Detection, Rock Detection, Slope, Path, Surface Potential









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% Axes, depth, diameter are in meters
%         Id      NACx         NACy         MapX         MapY         Longitude    Latitude
MajorAx           MinorAx      Conf         Depth        Diameter     f1_lon       f1_lat
f2_lon            f2_lat
           1      31.000000    647.000000     0.000000     0.000000   175.603687   -14.523627
8.177521          8.177521       0.882696     1.750542     5.803402
           2     164.000000    633.000000     0.000000     0.000000   175.602342   -14.523485
6.067193          5.803402       0.551909     0.968166     4.220656
           3     185.000000    659.000000     0.000000     0.000000   175.602130   -14.523748
0.791373          0.791373       0.897428     0.424569     1.582746
           4     293.000000    586.000000     0.000000     0.000000   175.601039   -14.523011
1.318955          1.318955       0.515028     0.000000     2.637910
           5     214.000000    624.000000     0.000000     0.000000   175.601837   -14.523395
1.055164          1.055164       0.869387     0.268521     2.110328
           6      29.000000    496.000000     0.000000     0.000000   175.603707   -14.522103
0.791373          0.791373       0.624331     0.569619     1.582746
           7      49.000000    534.000000     0.000000     0.000000   175.603505   -14.522487
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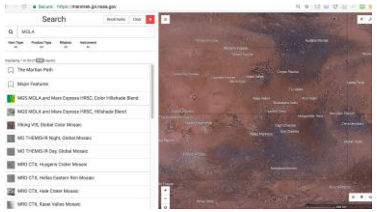

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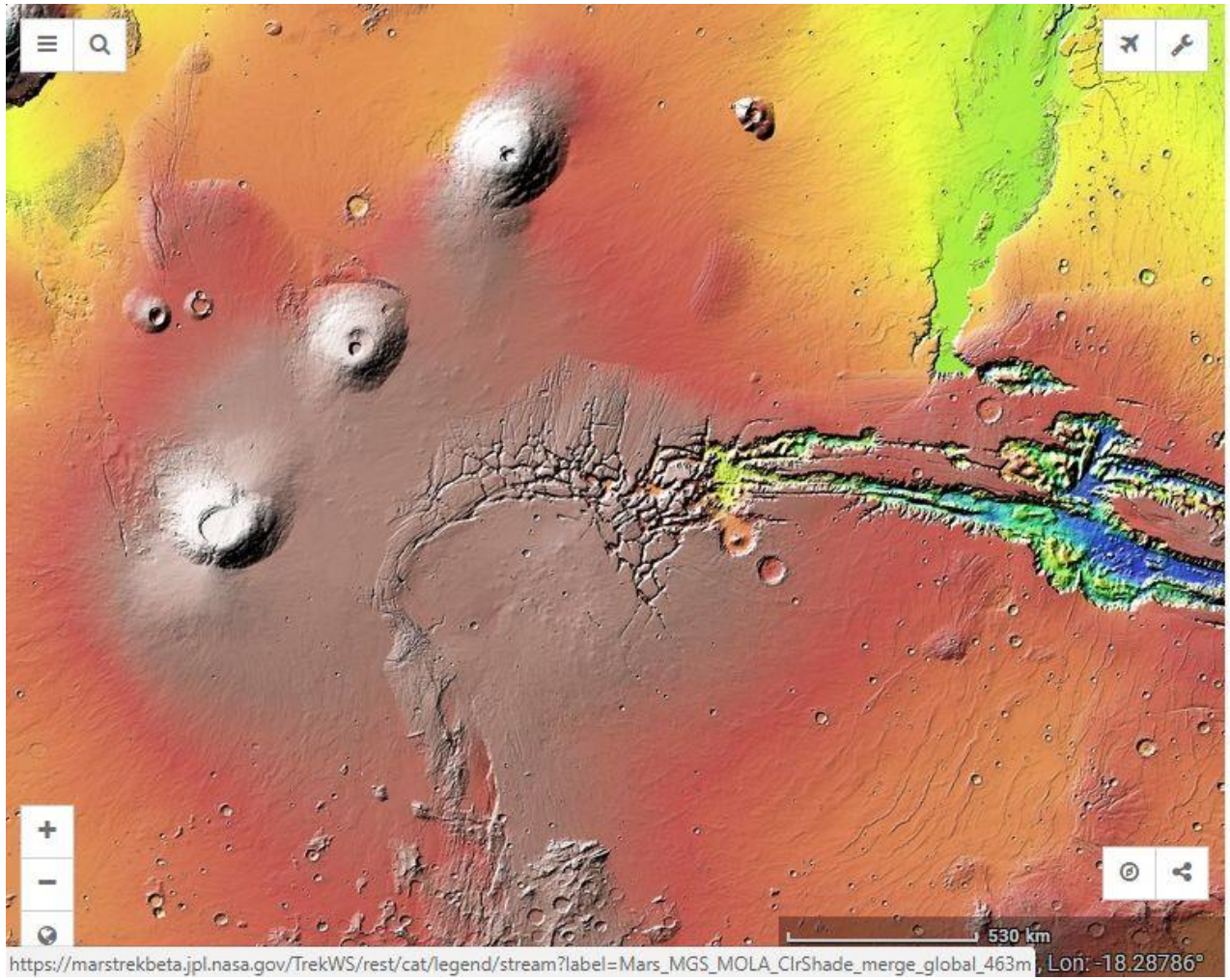
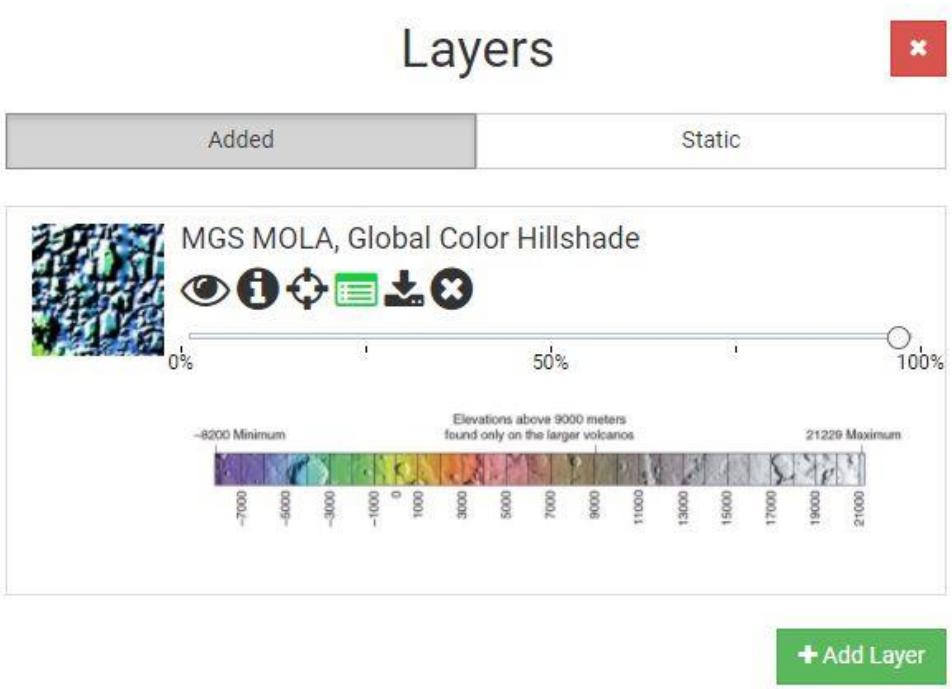
2D Visualization





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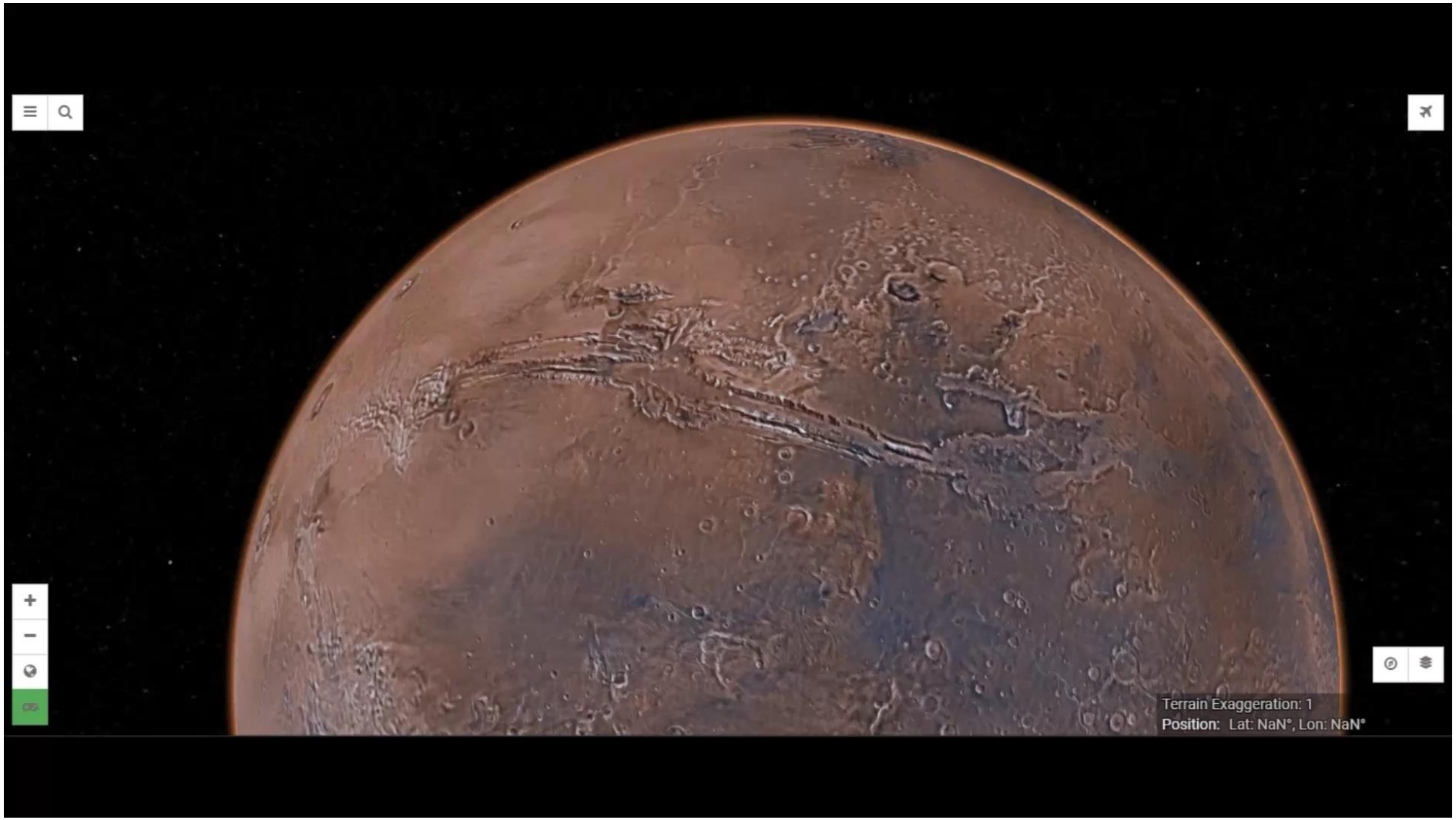
3D Visualization



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Other User Interface

Virtual Reality Client

Touch Table

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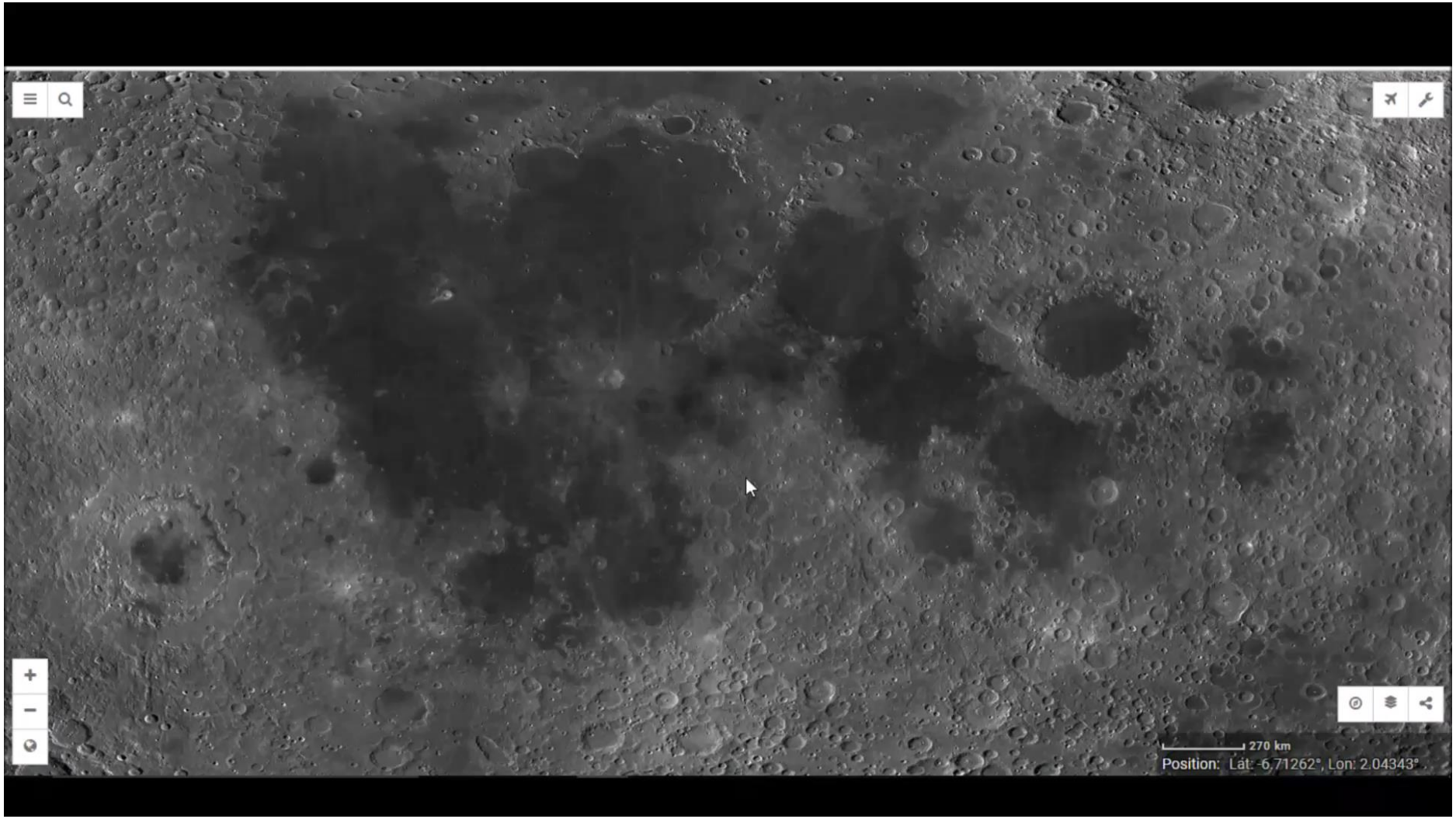
Viz & Analytics



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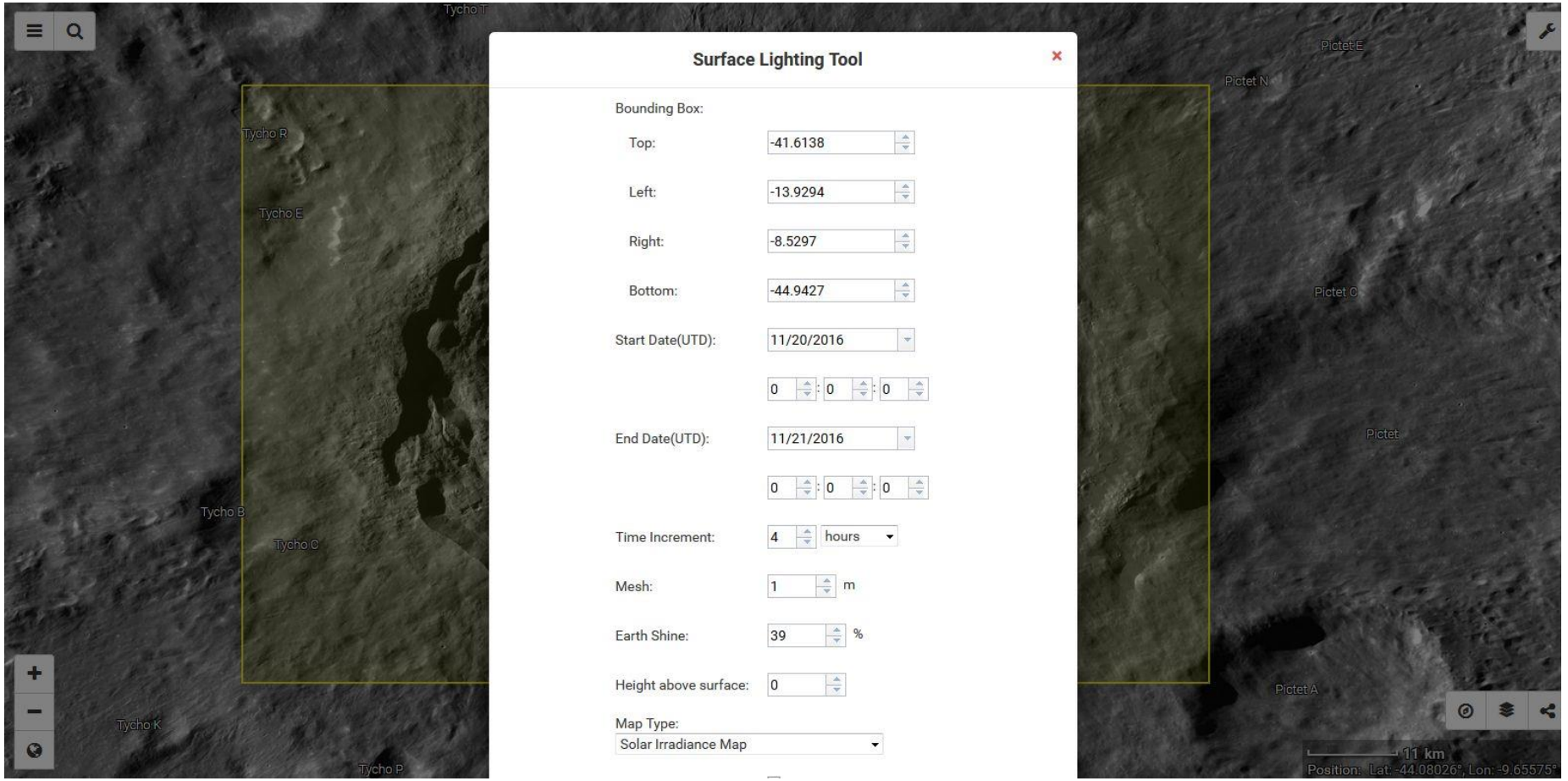
Lighting Analysis



Lighting Analysis

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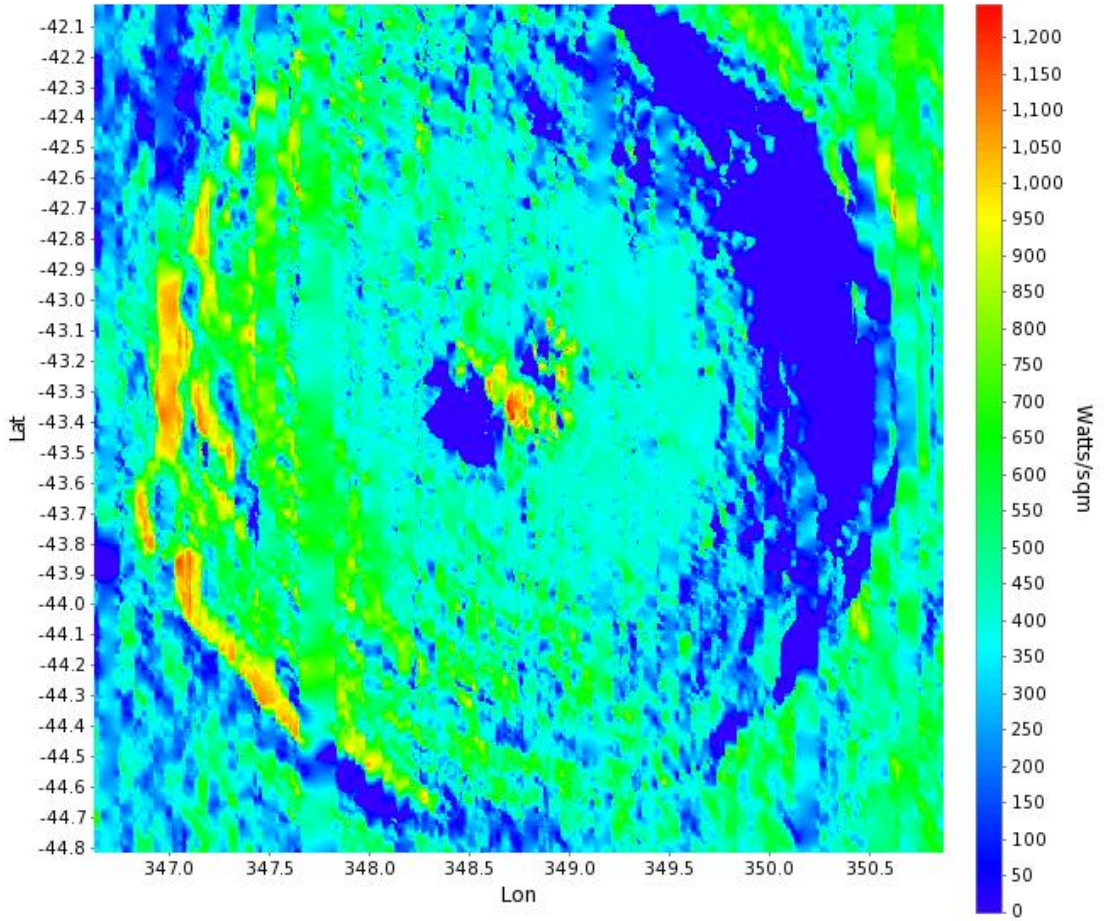
Lighting Analysis



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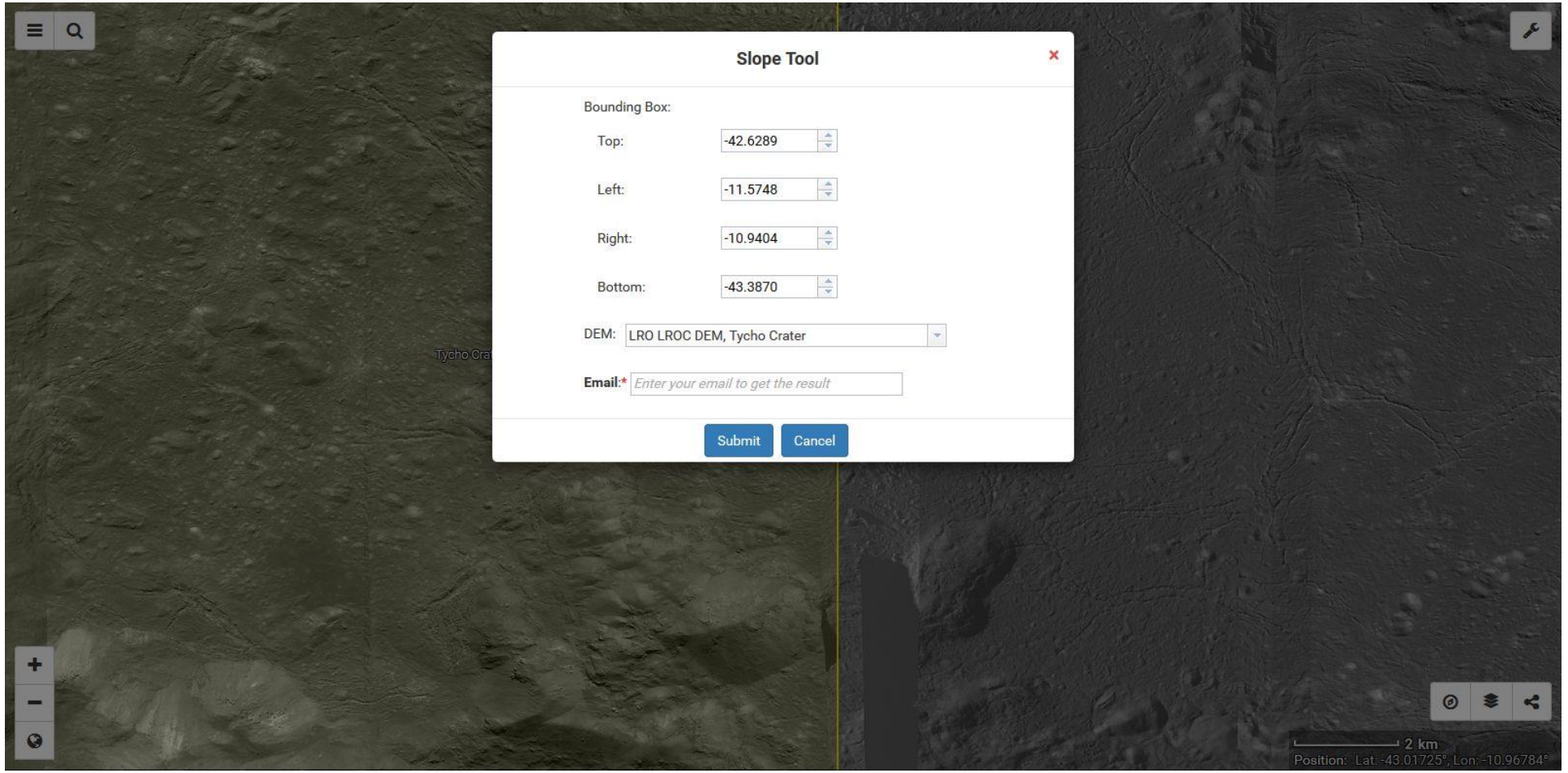
Slope Tool



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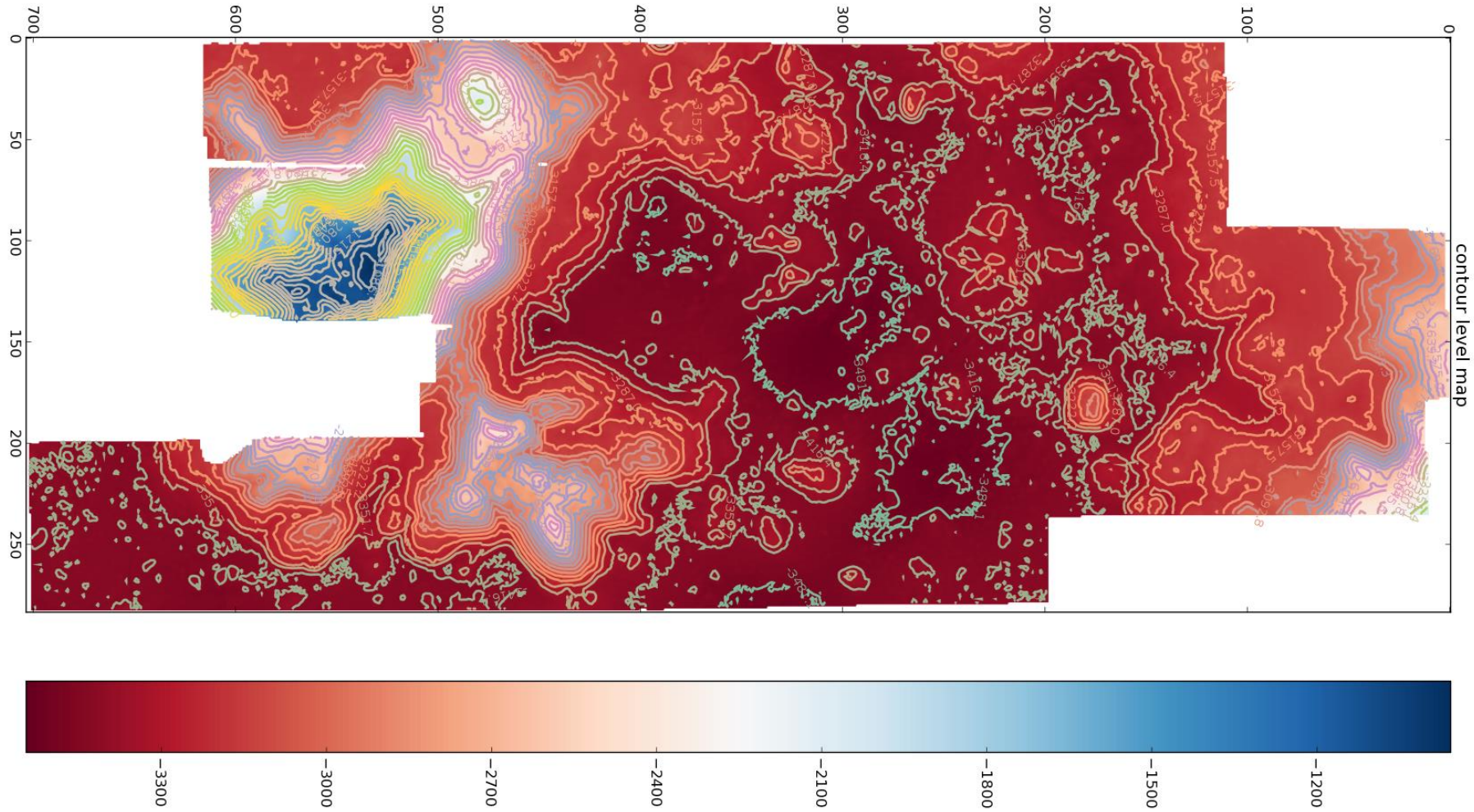
Slope Tool



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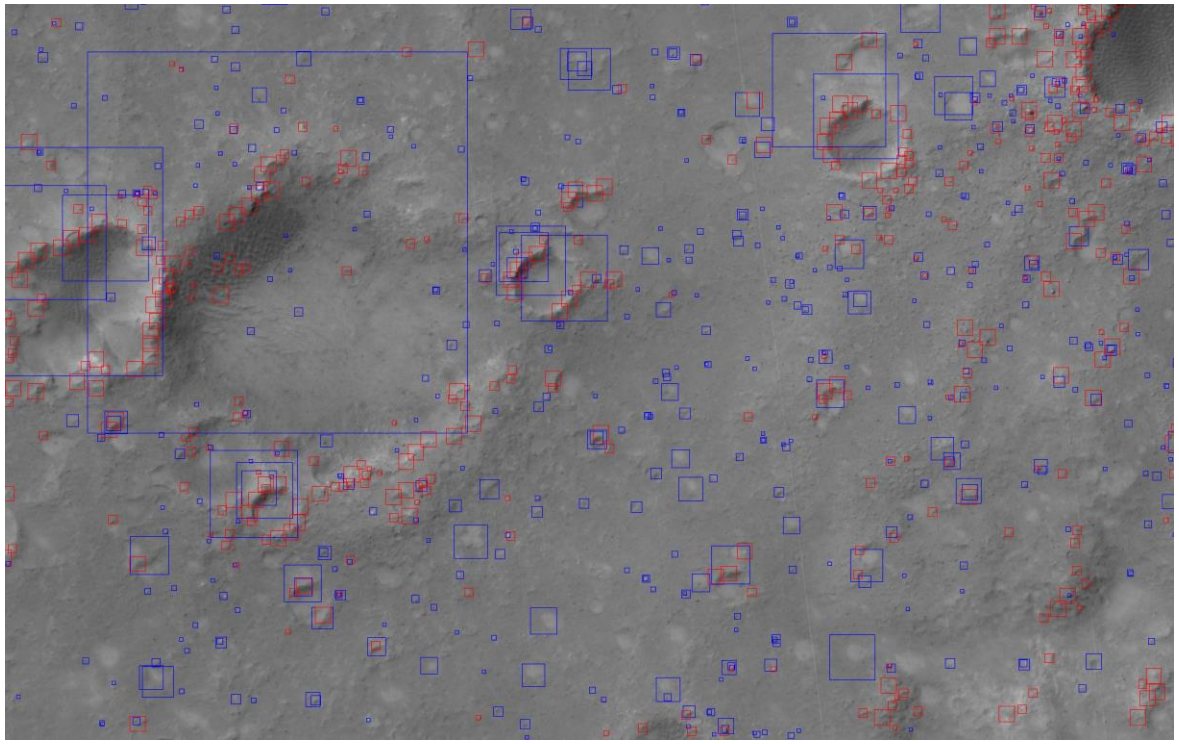
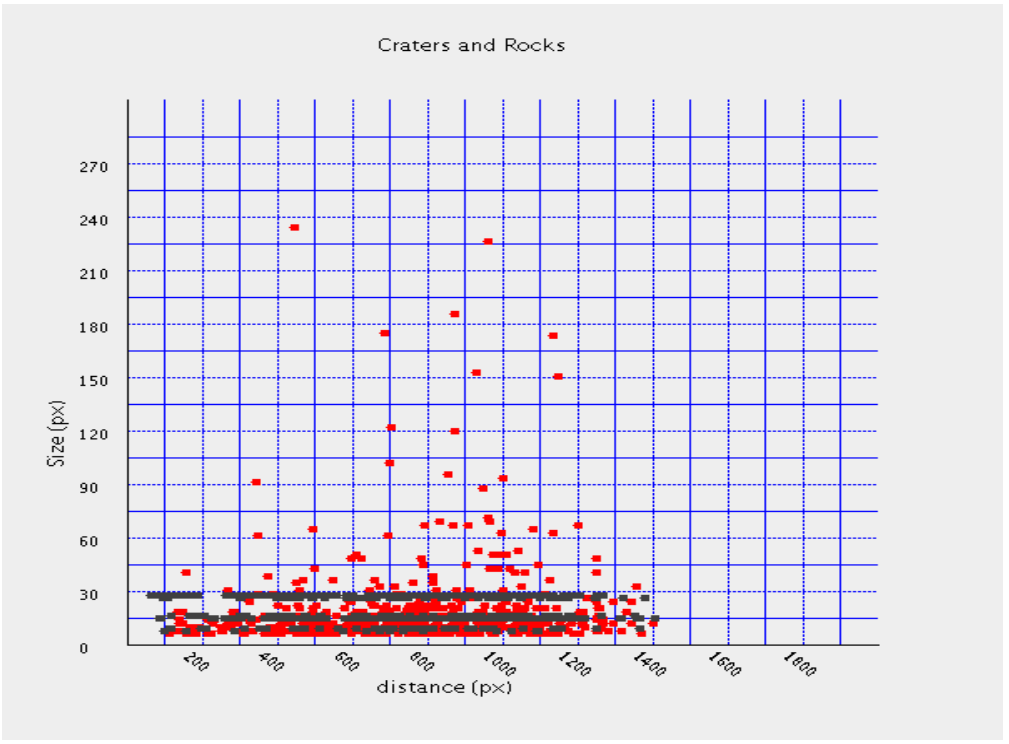
Crater/Rock Detection





Summary

- Planetary research is challenging
  - Proven technologies and capabilities of those tools available today, yet data usability remains a challenge
- Interactive Visualization and Analytics are critical to ease using planetary data
- Path forward
  - Invest and research in these key areas for all planetary bodies
  - Invest in value added products
- Additional SSTP web portals coming soon
  - Phobos Trek, Titan Trek, IcyMoons Trek, Ceres Trek

Help Us Improve

- What would be of value to you to have included:
  - Any data products
  - Any analytics tools and algorithms

- We welcome all feedback and suggestions

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Thank You

https://moontrek.jpl.nasa.gov
https://marstrek.jpl.nasa.gov
https://vestatrek.jpl.nasa.gov

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